# Research Statement

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My research focuses on two aspects of environmental economics: (1) measuring the impacts of emerging environmental hazards, and (2) evaluating policies that mitigate environmental damages, with an emphasis on the effective enforcement of pollution regulations. In this statement, I highlight my research papers in the context of three topics: the efficacy of intermittent pollution monitoring policies; health risks associated with the usage of large machinery in generating renewable energy; environmental and health impacts of wildfire pollution. A unified theme throughout my research agenda is to provide better understanding of environmental issues – particularly aspects that have received little attention – often combining large datasets and modern econometric methods to provide evidence of both academic and policy interests.

My job market paper, **"Unwatched Pollution: The Effect of Intermittent Monitoring on Air Quality,"** investigates how intermittent monitoring, a widely used cost-reduction tool in environmental regulation enforcement, incentives strategic responses so that polluting activities increase during unmonitored times. While the recent revelation of the Volkswagen emissions scandal has triggered substantial interest in this topic, little empirical evidence exists on the relevance of strategic responses to intermittent monitoring in broad-scale environmental regulations, largely due to the lack of independent measures of pollution during unmonitored times. I make progress by studying a national-scale ambient particle pollution monitoring policy where monitoring in many areas follows a supposedly "unbiased" once-every-six-day sampling schedule. To detect strategic responses, I construct an independent measure of air quality from 13 years of satellite data, which allows me to consistently observe pollution on both monitored and unmonitored days. My analysis reveals strong and pervasive strategic responses: air pollution drops sharply on monitored days, an effect that is detected in various regions of the country. I then show how the satellite data can be combined with information from traditional data sources (such as the U.S. Census, polluter registries, and local government response records) to learn about potential mechanisms underlying strategic responses and, perhaps more directly relevant to regulators, to highlight sources that deserve further regulatory investigation regarding potential origins of strategic responses. My research sends a clear message that monitoring policy design should be evaluated in terms of its potential to induce polluters' strategic behavior, along with a specific example of how satellites' unique ability to complement monitoring intermittency can be leveraged to achieve that.

My paper, **"Wind Turbine Syndrome: The Impact of Wind Farms on Suicide,"** provides a new step toward the understanding of the decade-long debate of the so-called "wind turbine syndrome." The phenomenon refers to complaints about annoyance symptoms (headache, nausea, dizziness and, most prominently, sleep

loss) from people who live near wind farms, and may be affected by the turbines' low-frequency noise emissions. Different from previous epidemiology literature that predominantly replies on small-scale survey evidence, I use a quasi-experimental estimation framework that exploits variation in wind farm exposure generated by over 800 utility-scale wind turbine installation events in the United States from 2001 to 2013. To better characterize wind turbine syndrome and to learn about its costs, I study wind farms' impact on suicide, an impulsive response that is understood to be closely related to sleep loss. My analysis yields robust evidence that wind farms increase suicide, with evidence pointing to a role of low-frequency noise exposure. For example, I show that the suicide effect of wind farms is driven by days when wind blows in directions that would raise resident's low-frequency noise exposure. While the paper provides the first national-scale evidence of the wind farms' adverse health consequences, suicide provides only a window onto the most severe potential outcome of wind farm exposure. This paper therefore invites further investigations on other potential health responses to wind farm exposure, such as hearing loss and sleep medication usage, which may help us better understand the value of noise abatement in future wind technology design.

I am also broadly interested in the health costs of important environmental hazards that previously have proved difficult to measure. I have pursued this research interest jointly with Nolan Miller and David Molitor through projects in which we combine Medicare administrative data with novel datasets about the environment. One example is our paper, **"Blowing Smoke: Health Impacts of Wildfire Plume Dynamics,"** in which we provide the first characterization of air quality, health, and healthcare spending consequences of wildfire pollution in the United States. We do this by utilizing a satellite-based dataset of wildfire smoke plumes produced by experts in the National Oceanic and Atmospheric Administration, which allows us to track day-to-day exposure to wildfire smoke in almost every location in the United States from 2005 to 2013. Linking smoke exposure to detailed health information contained in the Medicare data, we show that wildfire pollution poses a widespread, recurrent, and significant mortality risk among the elderly, with regions that generally have good air quality exhibiting the largest mortality responses. We find strong and consistent evidence that smoke exposure also increases healthcare use and spending.